Science Standards of Learning

Sample Scope & Sequence

Grade 4

Commonwealth of Virginia
Department of Education
Richmond, Virginia
2003

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Preface

As an additional resource to help school divisions develop curricula aligned to the 2003 Standards of Learning, the Virginia Department of Education has developed sample scope and sequence documents for kindergarten through grade eight and for core high school courses. These sample documents provide guidance on how the essential knowledge, skills, and processes that are identified in the Standards of Learning and the Standards of Learning Curriculum Frameworks may be introduced to students in a logical, sequential, and meaningful manner.

These sample scope and sequence documents are intended to serve as general guides to help teachers and curriculum developers align their curricula and instruction to support the Standards of Learning. Each sample document is organized around specific topics to help teachers present information in an organized, articulated manner. Also included are correlations to the Standards of Learning for that curricular area for a particular grade level or course, as well as ideas for classroom assessments and teaching resources.

The sample scope and sequence documents are not intended to prescribe how curriculum should be developed or how instruction should be delivered. Instead, they provide examples showing how teachers and school divisions might present to students in a logical and effective manner information that has been aligned with the Standards of Learning. School divisions that need assistance in developing curricula aligned with the Standards of Learning are encouraged to consider the sample scope and sequence guides. Teachers who use the documents should correlate the content identified in the guides with available instructional resources and develop lesson plans to support instruction.

The *Science Standards of Learning Sample Scope and Sequence* and the *Science Standards of Learning Curriculum Framework* can be found in both PDF and Microsoft Word file formats on the Virginia Department of Education's Web site at http://www.doe.virginia.gov/VDOE/Instruction/sol.html.

Introduction

The following sample scope and sequence is based on the essential content, skills, and processes developed for each Fourth Grade standard in the *Science Standards of Learning Curriculum Framework*. It is not intended to be a complete or exhaustive set of all that students should master at this level, but instead the scope and sequence organizes a core of key skills, content, and processes around basic topic areas.

The topic areas generally correspond to individual standards; however, certain standards are reorganized and grouped with components of other standards to comprise meaningful instructional clusters. The various topics are not intended to require equal instructional time. Additional objectives have not been developed, and no attempt has been made to transition or further explain the content. Additional information may be obtained from the overview and introductory sections of the Fourth Grade *Science Standards of Learning Curriculum Framework* (http://www.doe.virginia.gov/VDOE/Instruction/Science/sciCF.html).

An important and consistent thread among these organizational topics is the application of inquiry skills throughout. Students should have an opportunity to master the various science concepts in each topic area in the context of active learning and inquiry processes. The focus on inquiry is further reinforced by having the first topic in the scope and sequence as a discrete treatment of the science skills; however, a discrete treatment is certainly not required. This represents only one way to organize instruction; there are many other valid and useful organizational schemes.

Effective science teaching requires assessing and understanding what students know and need to learn and then challenging and supporting them to learn it well. The array of effective assessment techniques that teachers can employ in the classroom goes well beyond traditional assessments, and science instruction lends itself well to alternative approaches such as portfolios, student self assessments, and short videotaped presentations. The assessments mentioned in the scope and sequence are intended to be general. It is the role of the local curriculum to develop a detailed review of what is most effective for the particular concept being developed.

The resources section included in this scope and sequence provides a brief sample of instructional resources and staff development materials that are generally available without charge. There is a significant body of commercially available instructional materials that correlates well with the Science Standards of Learning and is of very high quality. This document, however, does not include references to those materials.

Organizing Topic	Related Standards
Investigation Skills	**4.1**
Investigating Plant Anatomy and Life Processes	**4.4, 4.1**
Investigating Ecosystems	**4.5, 4.1**
Investigating the Weather	**4.6, 4.1**
Investigating Motion	**4.2, 4.1**
Investigating Electricity	**4.3, 4.1**
Investigating Natural Resources	**4.8, 4.1**
Investigating the Earth-Moon-Sun System	**4.7, 4.1**

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigation Skills (A discrete introduction to specific science skills is not necessary, as all of the inquiry skills should be incorporated within the following topical areas. Teachers may consider introducing some of these skills in isolation or coordinated with mathematics, English, and history instruction.)	**Students should be able to:** differentiate among simple observations, conclusions, inferences, and predictions, and correctly apply the terminology in oral and written work. This requires students to comprehend the basic terminology and apply it in novel situations related to fourth grade SOL concepts. analyze a set of 20 or fewer objects, measures, or pictures; classify them into basic categories to organize the data (descriptive or numerical); and construct bar graphs and line graphs depicting the distribution of those data. use millimeters, centimeters, meters, kilometers, milliliters, liters, grams, and kilograms in measurement. choose the appropriate instruments, including centimeter rulers, meter sticks, graduated cylinders, beakers, scales and balances, and Celsius thermometers, for making basic metric measures. make predictions based on picture graphs, bar graphs, and basic line graphs.	4.1	Student demonstrations Classroom observations Student work Quizzes Tests	*Teaching and Learning the Basic Science Skills* videotape teacher training series, site guide: http://www.doe.virginia.gov/VDOE/Instruction/sol.html SOL assessment blueprints and sample items *Science SOL Curriculum Framework:* http://www.doe.virginia.gov/VDOE/Instruction/Science/sciCF.html DOE *Lessons from the Bay* teaching module http://www.doe.virginia.gov/VDOE/LFB/

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigation Skills (continued)	create a plausible hypothesis, stated in terms of cause and effect, from a set of basic observations that can be tested. This requires a student to comprehend what "cause and effect" is and to be able to apply that idea in new situations. The application should occur in terms of fourth grade SOL-related concepts or other concrete situations. Hypotheses should be stated in terms such as: "If the water temperature is increased, then the amount of sugar that can be dissolved in it will increase." analyze the variables in a simple experiment, and decide which must be held constant (not allowed to change) in order for the investigation to represent a fair test. This requires students to comprehend what "variables" are and to apply that idea in new situations related to fourth grade SOL-related concepts. Variables are either manipulated or responding. judge which, if any, data in a simple set of results (generally 10 or fewer in number) appear to be considerably outside the expected range. Students should be able to determine the significance of unusual data.	4.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Plant Anatomy and Life Processes	**Students should be able to:**		Student demonstrations Classroom observations Student work Quizzes Tests	School Gardening Website: http://www.kidsgardening.com/ DOE *Lessons from the Bay* teaching module http://www.doe.virginia.gov/VDOE/LFB/
	create a model/diagram illustrating the parts of a flower (stamen, pistil, sepal, ovary, ovuole, seed) and explain the functions of those parts. analyze a common plant: identify the roots, stems, leaves, and flowers, and explain the function of each. create a model/diagram illustrating the reproductive processes in typical flowering plants, and explain the processes. compare and contrast different ways plants are pollinated. explain that ferns and mosses reproduce with spores rather than seeds. explain the process of photosynthesis, using the following terminology: *sunlight*, *chlorophyll*, *water*, *carbon dioxide*, *oxygen*, and *sugar*. design an investigation to determine the relationship between the presence of sunlight and plant growth. explain the role of dormancy for common plants.	4.4		
	apply the 4.1 science skills in the context of the content of this topic.	4.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Ecosystems	**Students should be able to:** distinguish between structural and behavioral adaptations. investigate and infer the function of basic adaptations and provide evidence for the conclusion. understand that adaptations allow an organism to succeed in a given environment. explain how different organisms use their unique adaptations to meet their needs. describe why certain communities exist in given habitats. illustrate the food webs in a local area and compare and contrast the niches of several different organisms within the community. compare and contrast the differing ways an organism interacts with its surroundings at various stages of its life cycle. Specific examples include a frog and a butterfly.	4.5	Student demonstrations Classroom observations Student work Quizzes Tests	DOE *Lessons from the Bay* teaching module http://www.doe.virginia.gov/VDOE/LFB/ *Our Living Environment* teacher training module: http://www.doe.virginia.gov/VDOE/Instruction/OurLivingEnvironment.doc *Project WILD activity guide:* http://www.dgif.state.va.us/education/wildlife_education.html *Project Wild Aquatic* activity guide: http://www.projectwild.org/materials/materials.htm

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Ecosystems (continued)	differentiate among positive and negative influences of human activity on ecosystems.	4.5		*Project Learning Tree:* http://www.plt.org/ *Project WET activity guide:* http://www.deq.state.va.us/education/wetinfo.html
	apply the 4.1 science skills in the context of the content of this topic.	4.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating the Weather	**Students should be able to:** use a thermometer to compare air temperatures over a period of time. analyze the changes in air pressure occurring over time, using a barometer, and predict what the changes mean in terms of changing weather patterns. differentiate between the types of weather associated with high- and low-pressure air masses. Illustrate and label high- and low-pressure air masses and warm and cold fronts. differentiate between cloud types (cirrus, stratus, cumulus, and cumulo-nimbus clouds) and the associated weather. compare and contrast the formation of different types of precipitation (rain, snow, sleet, and hail). recognize a variety of storm types, describe the weather conditions associated with each, and explain when they occur (thunderstorms, hurricanes, and tornadoes). analyze and report information about temperature and precipitation on weather maps.	4.6	Student demonstrations Classroom observations Student work Quizzes Tests	DOE *Lessons from the Bay* teaching module http://www.doe.virginia.gov/VDOE/LFB/ NOAA Weather Education resources: http://www.education.noaa.gov/ Weather Channel education resources: http://www.weather.com/education/ Virginia Earth Science Resource Page – Meteorology: http://vtso.geol.vt.edu/vesr/meteo/vesrmeteo.html

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating the Weather (continued)	measure wind speed, using an anemometer. measure precipitation with a rain gauge. design an investigation where weather data are gathered using meteorological tools and charted to make weather predictions.	4.6		
	apply the 4.1 science skills in the context of the content of this topic.	4.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Motion	**Students should be able to:**		Student demonstrations Classroom observations Student work Quizzes Tests	*Physical Science SOLutions* module: http://www.smv.org/pubs/index.html
	describe the position of an object. collect and display in a table and line graph time and position data for a moving object. explain that speed is a measure of motion. interpret data to determine if the speed of an object is increasing, decreasing, or remaining the same. identify the forces that cause an object's motion. describe the direction of an object's motion: up, down, forward, backward. infer that objects have kinetic energy. design an investigation to determine the effect of friction on moving objects.	4.2		
	apply the 4.1 science skills in the context of the content of this topic.	4.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Electricity	**Students should be able to:** apply the terms *insulators*, *conductors*, *open* and *closed* in describing electrical circuits. differentiate between an open and closed electric circuit. use the dry cell symbols (–) and (+). create and diagram a functioning series circuit using dry cells, wires, switches, bulbs, and bulb holders. create and diagram a functioning parallel circuit using dry cells, wires, switches, bulbs, and bulb holders. differentiate between a parallel and series circuit. create a diagram of a magnetic field using a magnet. compare and contrast a permanent magnet and an electromagnet.	4.3	Student demonstrations Classroom observations Student work Quizzes Tests	*Physical Science SOLutions* module: http://www.smv.org/pubs/index.html

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Electricity (continued)	explain how electricity is generated by a moving magnetic field. design an investigation using static electricity to attract or repel a variety of materials. explain how static electricity is created and occurs in nature. construct a simple electromagnet using a wire, nail, or other iron-bearing object, and a dry cell. design and perform an investigation to determine the strength of an electromagnet. (The manipulated variable could be the number of coils of wire and the responding variable could be the number of paperclips the magnet can attract.) describe the contributions of Ben Franklin, Michael Faraday, and Thomas Edison to the understanding and harnessing of electricity.	4.3		
	apply the 4.1 science skills in the context of the content of this topic.	4.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Natural Resources	**Students should be able to:**		Student demonstrations Classroom observations Student work Quizzes Tests	DOE *Lessons from the Bay* teaching module http://www.doe.virginia.gov/VDOE/LFB/ *Virginia Naturally: VA's Natural Resources Education Guide:* http://www.vanaturally.com/guide.html Luck Stone *Rock* interactive multimedia kit Chesapeake Bay Program: http://www.chesapeakebay.net/ Chesapeake Bay History: http://www.chesapeakebay.net/pubs/gateways/plainandpiedmont/index.htm
	compare and contrast natural and man-made resources. distinguish among rivers, lakes, and bays; describe characteristics of each; and name an example of each in Virginia. create and interpret a model of a watershed. Evaluate the statement: "We all live downstream." identify watershed addresses. recognize the importance of Virginia's mineral resources, including coal, limestone, granite, and sand and gravel. appraise the importance of natural and cultivated forests in Virginia. describe a variety of soil and land uses important in Virginia.	4.8		
	apply the 4.1 science skills in the context of the content of this topic.	4.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating the Earth-Moon-Sun System	**Students should be able to:** differentiate between rotation and revolution. describe how the Earth's axial tilt causes the seasons. model the formation of the eight moon phases, sequence the phases in order, and describe how the phases occur. describe the major characteristics of the sun, including its approximate size, color, age, and overall composition. create and describe a model of the Earth-moon-sun system with approximate scale distances and sizes. compare and contrast an Earth-centered to the sun-centered model of the solar system. analyze the differences in what Aristotle, Ptolemy, Copernicus, and Galileo observed and what influenced their conclusions. compare and contrast the surface conditions of the Earth, moon, and sun. describe a contribution of the NASA Apollo missions to our understanding of the moon.	4.7	Student demonstrations Classroom observations Student work Quizzes Tests	DOE *Lessons from the Bay* teaching module *The Earth in Space Teacher Training:* http://www.smv.org/pubs/index.html NASA Space Resources electronic publications: http://spacelink.nasa.gov/.index.html NASA Education Homepage: http://education.nasa.gov

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating the Earth-Moon-Sun System (continued)	apply the 4.1 science skills in the context of the content of this topic.	4.1		